

Soil Health news



December 2012

Down to earth information...

15 wishes for Africa on World Soil Day...

To coincide with World Soil Day, 5 December 2012, ASHC asked some of the leading thinkers on issues associated with integrated soil fertility management (ISFM) to 'make a wish'.

These ideas are being shared to inspire and perhaps, in some cases, to provoke. They are not necessarily ideas shared or endorsed by ASHC, or our funders, and some are contradictory. But by exploring these big ideas our experts wanted to advocate for the coming year, we hoped it would challenge our thinking.

You will see in the newsletter we start with the vision of how the research continuum can be reformed to bring farmers into the frame. A cluster of wishes look at the creation of down-to-earth information for farmers or demonstrations that drive home the potential benefits of new techniques. We have ideas that look at the opportunities for harnessing low cost inputs of organic matter. We also look at fertilizer subsidy and ask the \$2 billion question.

Many of our contributors have been thinking about how women can be better supported. I myself focused on another aspect of gender by considering how ISFM can impact on young people. Finally we think about the issue of capacity building – and ask if soil is actually taken seriously enough.

No one pretends it is easy to deliver these wishes. But imagining an Africa with these few wishes in place means that I can envisage

a future World Soil Day that is a genuine cause for celebration.

Please let us know what you think, or even what you would wish for to improve soil fertility in Africa – we will be happy to consider your wish for publication on the website.

Best wishes
George Oduor
Project manager ASHC



George Oduor discussing intercropping cassava and legumes with Lydia Wairegi in Rwanda

In this issue...

	Page
Research	
Redefining the research-to-extension continuum to include farmers Christian Witt	2
Better packaged research findings for smallholders Charles S Wortmann	3
Extension	
Who will feed Africa in the future? George Oduor	4
Share ideas and knowledge Bell Okello	5
Can we keep it friendly? Duncan Sones	6
Showing beats telling Peter Okoth	7
Less labour-intensive ways to restore soil fertility Raymond Jumah	8
Inputs	
Fixing nitrogen from the air Ken Giller	9
Expanding the benefits of legumes on soils Bashir Jama	10
Fertilizer: The \$2 billion questions Valerie Kelly	11
Fertilizer subsidy needs to clean up its act Francis Tetteh	12
Organic matter matters Mariana C Rufino	13
Tree wishes Floice Adoyo	14
Land	
A human rights perspective on women's land tenure Margaret Kroma	15
Capacity building	
A bigger slice, a bigger cake Marie Rarieya	16



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Redefining the research-to-extension continuum to include farmers

Christian Witt wants to redefine the research-to-extension continuum to include farmers...

“At the Bill & Melinda Gates Foundation, we see healthy soil as a gateway for farmers to increasing farm productivity and thereby reducing poverty. But if I were granted a wish it would be that we used our creativity to find more innovative ways to connect with farmers, her families and communities, at scale.

Sustainable farming depends on making informed choices on crops to grow, input use, and management practices considering economics and risks. Research informs some of these choices but it takes knowledge on how to adapt recommended practices to local conditions.

If I were granted a wish it would be that we used our creativity to find more innovative ways to connect with farmers, her families and communities, at scale.

We are all familiar with the traditional models of how research is distilled into learning and then extension delivers these messages to the field. But in a technological age there has to be a new compact between organizations that creates a two-way flow of information. For the first time in Africa, technology is allowing mass data to be collected – from digital soil mapping using novel spectral analysis and satellite imagery at one end of the spectrum, to the texted information from a community forecaster at the other.

We are seeing the development of technology-driven models for farmer-to-farmer knowledge sharing led by organizations such as the Grameen Foundation in Uganda or Digital Green in India. I think it is a small step for the community

Christian Witt manages work on ‘Input Delivery’ for the Bill & Melinda Gates Foundation and a grant portfolio aiming to increase soil fertility and productivity in smallholder farming. Prior to joining the foundation he worked in international agricultural research and has over 15 years experience in plant nutrition and soil nutrient management in the tropics.



Witt spent most of his career working in Asia. From 2004 to 2009 he was director of the International Plant Nutrition Institute (IPNI) Southeast Asia based in Singapore and Malaysia. He also worked at the International Rice Research Institute (IRRI) in the Philippines, starting his PhD in 1993 and later becoming an affiliate scientist.

A native of Germany, he has coordinated multi-national research projects working on rice, maize, wheat and oil palm, published more than 100 papers and developed a wide range of training materials and extension tools including pocket guides, several software applications, film and a leaf color chart for efficient N management in rice. He is co-developer of the site-specific nutrient management approaches for rice and maize in Asia.

knowledge workers at Grameen using smartphones to enable these processes to systematically gather information from diagnostic exercises. This approach would dramatically improve what we know about farmer level problems and practices at scale. Pulling in remotely sensed data and models would pave ways to develop smarter decision support tools that offer fewer, more relevant choices to be communicated locally.

The scale of the dissemination task is huge and we need to be creative in the way we respond. We need new definitions of the research–dissemination continuum with much greater thought about what is the research priority. And we need to

harness technology to give constant feedback from the field on what is happening at the implementation stage, collecting farmer-led innovations and relevant indigenous knowledge along the way.”



Research findings better packaged for smallholders

Charles S Wortmann wishes for more research to determine optimal crop-nutrient application rates...

“Sustainably increased crop productivity by most smallholders requires the integration of fertilizer use with other soil management practices.

Fertilizer use often is not sufficiently profitable to compete with other demands faced by capital-constrained farmers. Net returns to fertilizer use can be improved by subsidies, more efficient input supply and by marketing, but the smallholder farmer typically has little influence on these.

Smallholder farmers can greatly improve net returns to fertilizer use by optimized choice of crop-nutrient-rate combinations. Net returns to fertilizer use vary greatly for crop-nutrient combinations. Net returns are further affected by rate of application – as crop response to applied nutrients is commonly curvilinear – with greatest net returns at rates where the response curve is steep.

The severely capital-constrained farmer may be able to apply fertilizer for only one or a few crop-nutrient combinations initially, and then at low or modest rates.

Net returns to fertilizer use can be improved by subsidies, more efficient input supply and by marketing, but the smallholder farmer typically has little influence on these.

The high net returns on investment, however, will enable smallholders to gradually increase their fertilizer use to the point of maximizing net returns per hectare for all of their crop land.

The information needed to maximize net returns to fertilizer use by choice of crop-nutrient-rate combinations is inadequate for most crops, in most African countries.

My wish is that research is undertaken to determine crop-nutrient response functions, coupled with effective information dissemination including through cell phone technology. This would enable the millions of smallholders to optimize crop-nutrient-rate choices”.

Down to earth information

The Africa Soil Health Consortium is building a portfolio of exemplar materials that set out to encourage the implementation of proven integrated soil fertility management approaches in sub-Saharan Africa.

Farmer-friendly extension information will help **smallholders** make rational investment decisions in relation to ISFM.

Extension workers and agrodealers will have access to learning tools that assist with the dissemination of information on ISFM.

Policy makers will be able get information that helps them consider the benefits of ISFM and suggests ways in which they could create an environment conducive to ISFM uptake.

Trainers, college and university lecturers will have access to high quality teaching and learning materials that support entry-level learning and professional development in ISFM.



Charles S Wortmann

Professor of agronomy and soil science, University of Nebraska-Lincoln

Research interests: improvement of no-till systems; nitrogen and phosphorus management for improved nutrient use efficiency, water quality protection, and nitrous oxide emissions; crop management for energy-efficient biofuel production; and improving soil and water management for sorghum production in eastern Africa.

Major project activities: research and extension for more profitable and environmentally safe nutrient management, improvement of no-till systems, energy-efficient biofuel production, and support to sorghum research in eastern and southern Africa.

Extension interests: soil fertility management, nutrient management planning, manure use, water quality protection and climate change issues.



Who will feed Africa in the future?

George Oduor wishes we thought more about the messages we give young people about agriculture....

“The age profile of farmers in Africa is hard to determine – but let us assume the average age of farmers is 50. It’s probably more. Young people are not attracted to the life of backbreaking drudgery they associate with farming. So, large numbers pack off to the urban areas and eke out a living in the margins of society. The ‘bright ones’ head off to be government servants, including teachers.

I wish we could change this perception...

Africa’s need for food is growing, as both the population and urbanization keep growing. So why aren’t young people excited by the possibilities of scientific advances which can make farming in Africa a real business?

I wish more young Africans

- saw examples of people making a success of farming
- were taught that farming can be a good business
- were not made to weed the vegetable plot as a form of punishment
- were not told that agriculture is for those not able to do anything else

Ironically when I meet farmers’ leaders, they are often retired teachers whose pensions are supplemented by their agricultural productivity.

What can we do?

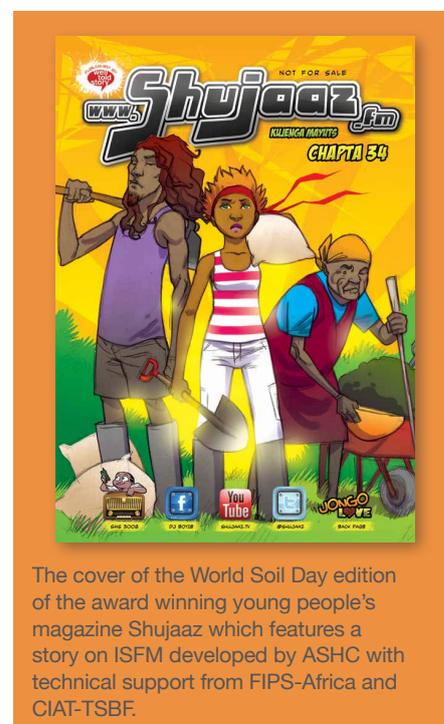
This month ASHC is attempting several experiments to reach young people in Kenya.

First we have designed a science lesson based on integrated soil fertility management (ISFM) with educational publishers at Young African Express, a bi-monthly

educational magazine that targets the youth through their teachers. But we have gone two steps further! We have launched a competition for an ISFM poster – with the prize of a laptop for the winner. We need to show that farming pays.

Once a school has all of the posters designed we are challenging them to run an advocacy campaign for local farmers. Schools remain one of the few trusted sources of information in local communities. The best ISFM campaign wins a farm kit and greenhouse that can supply the whole school with lunches. Kids that are not hungry learn better in all subjects – as well as seeing how farming can be highly productive and rewarding.

Second, we are using youth culture to bridge the generations. Emmy award winning Shujaaz FM has helped us develop a storyline which makes ISFM look cool and links it to high agricultural returns. 600,000 comics will circulate for years to come with that information, and 22 syndicated radio stations and social media will reinforce the message.



The cover of the World Soil Day edition of the award winning young people’s magazine Shujaaz which features a story on ISFM developed by ASHC with technical support from FIPS-Africa and CIAT-TSBF.

Young people want jobs with swagger... in Shujaaz we are presenting swag’riculture.

We will let you know how we get on...”



George Oduor (right)

George is deputy director of CABI Africa and project manager for ASHC.

George previously worked at Kenya Agricultural Research Institute (KARI). He has over 20 years’ experience in the development, implementation and coordination of national and regional multi-institutional research and development projects in the tropics. He has a keen interest in the developmental aspects of participatory agricultural research.

Share ideas and knowledge

Bell Okello wishes information dissemination to farmers, and especially to women farmers, in rural areas in Africa could be improved...

“Both men and women work the soils to produce food and agricultural crops for the markets. Agricultural production is carried out mainly on a small scale by poor farmers, where the objective is largely household food security, which is hardly achieved.

A major characteristic of smallholder farming in many parts of Africa is paucity of information: information on agronomic practices, markets, market prices, and soil behavior among others. Soil stands out, because it is the basic resource with which farming is undertaken.

Many studies, reports and anecdotal information suggest that while many smallholder farmers may have some knowledge about their soils, most do not know what to do to make their soils increase yields on a sustainable basis. Inadequate knowledge on how best to manage the soils for the production and productivity levels many farmers desire, can be traced to paucity of simple and easy to access information on the soils. This includes information on soil types, the kind of management they require and the optimal crops to be grown. Sadly, women farmers are at a greater disadvantage in accessing this information due to many reasons such as their heavy workload, low literacy levels and cultural values, norms and practices among others.

In many cultures, men make all the decisions about land (soil) use, including what to plant, when to plant and even how to use the benefits (yields and incomes) from the agricultural activities. Quite often, women are at the other end of the agricultural production chain, providing the labor. As a consequence, women are the ‘true’

Bell Okello is the gender, agriculture and rural development specialist at the International Centre for Research on Women, and heads the East Africa Regional Office (EARO) based in Nairobi.

A trained agriculturalist and rangeland management specialist, Bell has worked as a researcher, lecturer, development worker and a consultant in development programs. His current work focuses on practical and sustainable approaches that promote gender equality and specifically, women’s participation in agricultural value chains. Dr Okello’s academic, research, teaching, consultancy and development work experience has been in East, West and Southern Africa; India, the Netherlands and US.



managers of the soils and they probably have better ‘knowledge’ of the soils. But they cannot do anything to sustain or shape production.

The biggest irony is that there is plenty of information on best practices of soil management; however, most of this information is inaccessible, especially to the smallholder and poor farmers, majority of who are women.

Access to information can change many things on how soils are managed, and therefore on productivity and incomes. If women farmers can access the relevant information on various aspects of soils (types, nutrients, structure etc), we can expect to see enhanced efforts at more sustainable and productive soils.

The biggest irony is that there is plenty of information on best practices of soil management; however, most of this information

is inaccessible, especially to the smallholder and poor farmers, majority of who are women.

When available, the information exists in technical terms that even farmers with high school education cannot understand. There is thus a need to have simple, easy-to-comprehend information for the farmers, especially targeting the majority of smallholders.

Even if available, accessing such information will remain a significant challenge, especially to the women farmers. This is because most public extension systems in Africa are struggling and in various stages of decay.

Finding ways and means of sustainably enhancing access to this information is key. I think that agrodealers are a potential window for farmers to easily access this information. In addition, this information can be channeled through adult education/ literacy classes, where women are the majority.”

Can we keep it friendly?

Duncan Sones wishes we could keep communications on ISFM farmer friendly, practical and inclusive

“I wish we could come together as a community of practice and agree some ground rules on communicating ISFM to smallholders.

Too often there are a series of disconnects between the research institutions that use public funds to work out what farmers should be doing, and the actual needs of farmers. Researchers are judged in terms of the journal papers they write, rather than how they affect changes in food security. So researchers can usually only write in academic terms.

Too often there are a series of disconnects between the research institutions that use public funds to work out what farmers should be doing, and the actual needs of farmers.

Researchers, however, do know the reality of what smallholders face. In a series of workshops in Ghana facilitated by ASHC researchers, extensionists and farmers’ representatives worked together to set out rules for the creation of farmer-friendly printed information. There was complete consensus about what the materials needed to look like. We got into the mindset of the farmer and empathized with challenges they faced.

Most research suggests very precise measurements of spacing between rows and plants or amounts of fertilizer or other materials to be applied to a hectare. In reality most farmers lack basic measuring equipment and have little idea what their field size is – realistic techniques for explaining

measurements are required. Such as cola crown top of fertilizer per plant or spacing rows a panga/cutlass length apart.

There are ways we can present rational and understandable economic data to farmers. This should include:

- A clear cost benefit analysis (even allowing for fluctuating commodity values).
- Clear comparisons e.g. showing photos of with improved seed and without
- Information on likely markets for surpluses.

Through other consultations we have started to get an insight into how to ensure that our materials are more women-farmer friendly. Whilst colleagues were preparing a film on the application of manure – it became clear that women had access only to small animal manure for their gardens. So the ISFM film was amended to show both large and small animal manure being applied.

Our consultations seem to show that older farmers are less literate. So this presents real challenges for packaging ISFM information. TV is the perfect media for show and tell – but it is not accessible to the majority of smallholders. So we need to find innovative ways of shaping ISFM messages for radio. Radio tends to be listened to by whole families and although women are often completing chores whilst the radio is on, this doesn’t disadvantage them to the same extent as not being able to see the TV.

Whilst an essential part of ISFM is local adaptation – the communications rules will need only

very small amounts of nuancing to be applicable across Africa.

So let’s train scientists to communicate what they know in ways that will change farmers’ behavior and let’s give career promotions to those that do this effectively. Let’s help extensionists to do their jobs and let’s listen to farmers’ feedback on materials we produce and make sure the information is the best it can be”.

Guidelines for producing farmer-friendly, printed, extension materials can be found in the materials section of the ASHC website.



Duncan Sones facilitating an ASHC write-shop in Hohoe, Ghana

Duncan is a communications associate for the Africa Soil Health Consortium.

He has also provided communications support to GALVmed and the UKAID funded Research Into Use programme.

Showing beats telling

Peter Okoth wishes for better demonstrations to convince smallholder farmers of the need to feed their soil so it can feed them...

“Too often African soil is exhausted of nutrients. African farmers continuously plant the same crop – often maize - without attending to their soil.

The research and extension communities haven't found a way to connect with farmers and convince them of the need for change. I want farmers to really understand that their soil is like a larder – it starts off full of goodness but gradually, over time, the larder reduces until there is almost nothing left to feed the crop. Simply put, you cannot get the same yields again and again without replenishing the nutrients that the plant requires to produce good yields.

So my wish would be to have a comprehensive series of demonstration plots

This would involve a diverse range of farmers in some simple experiments showing what happens to a soil that is not replenished - compared to a soil that gets regular replenishment. These plots need to be shown on television, or moved wholesale to the agricultural shows... anything we can think of to get people seeing the reality of what good soil husbandry can do.

The researchers, extension service and agrodealers need to work together to find the best way to explain what farmers need to do to replenish their soil. This needs to be in simple straightforward language. The guidance needs to be clear and based on the equipment that farmers have, and the things they can observe as the test for what is



Peter Okoth discusses with farmers the benefits of good maize crop agronomy and how best to apply fertilizers for optimised yields

Peter has worked for the International Centre for Tropical Agriculture Tropical Soil Biology and Fertility Institute (CIAT-TSBF) since 2003.

He is currently the principal researcher responsible for serving end users, capacity building, and policy in the project: A Globally Integrated African Soil Information Service (AfSIS) being implemented in sub-Saharan Africa.

needed. Too often farmers are told to get their soil tested in laboratories– which is usually not possible - and then they are told in language they don't understand to apply inputs they can't get.

Great demonstration plots will clearly help farmers to understand what they need. They will see the benefits of the difference they are able to make.

The instructions to farmers must include clear explanations and illustrations. It should include the need for organic matter as well as the basic mineral nutrients the crop requires. Farmers must be made to understand the differences between the fertilizers and the nutrients,

including what they are and how each affects their own soil and productivity.

Use of fertilizers or nutrients needs to be cost-benefit driven. So, we need to say 'if you apply so many spoons of nutrient or fertilizer to the soil, you get this many more bags of maize'.

We may even suggest that farmers do some basic record keeping and maybe learn to draw graphs that match the productivity to the amount of nutrients used.

I think this would get farmers closer to restoring their soil health.”

Less labour-intensive ways to restore soil fertility

Raymond Jumah's wish would be to promote less labour-intensive ways to restore soil fertility...

"I wish we could persuade more farmers in sub-Saharan Africa that there are affordable, often less labour-intensive, solutions to counter soil infertility.

Poor soils and deplorable living conditions for smallholders are a common story in Africa. Sadly governments, and their research institutions that have been working to improve agricultural productivity and farmer livelihoods, have had little success.

Soil health improvements rely on the transfer of technical knowledge to achieve behaviour change. Unfortunately it often takes several seasons for a clear benefit to show. Farmers often give up before the results have fully materialized.

Successful adoption requires soil health technologies to be presented in a way that builds on existing practices with benefit to farmers within a season. Importantly, this does not have to be the primary 'soil health' benefit that the technology was originally designed for. Without links between researchers, extensionists and farmers, it is impossible to design technologies and dissemination methods that achieve this.

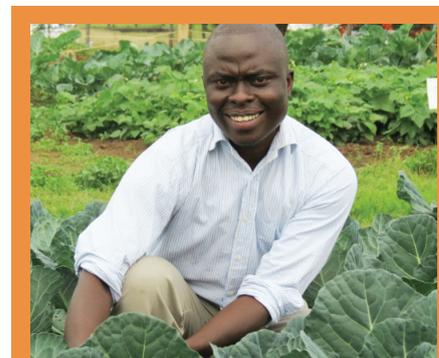
I am part of Farm Input Promotions Africa (FIPS-Africa), a not-for-

profit organization that works with smallholder farmers offering tested innovative approaches and providing information and advice.

Advice from government extension officers often say the same thing; 'buy hybrid seed, use DAP when planting and CAN for top dressing,' regardless of the nuances of the research. This is not bad advice. However, fertilizers will not achieve the desired results unless used properly.

By working with farmers, we can understand that traditionally, they either broadcast their fertilizers and manure (if it is available) or place it on top of the seed in the planting hole – resulting in the seed being burnt and the phosphorus (which is immobile) being unavailable to the plant roots. We therefore promote use of fertilizer alongside practical advice on placement of fertilizer in the planting hole, but separate from the seed. This results in increased yields immediately, even if only manure is applied.

Our target small farmers are generally poor and not able to purchase 50kg of fertilizer or even 2kg of improved seed; in any case these pack sizes are too big for them. We facilitate on-farm trials with tiny free packs of seed and several fertilizer companies now sell 1kg bags in Kenya, Tanzania and Nigeria.

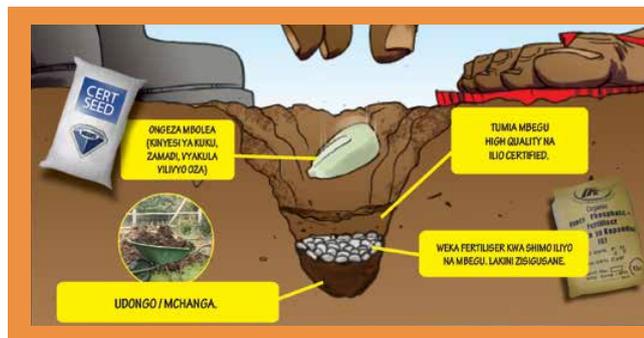


Raymond is a journalist working for FIPS-Africa, an organization based in Nairobi Kenya.

The 28-year-old has passion for agriculture and has toured different regions of Kenya and Tanzania interviewing smallholder farmers on various issues revolving around agriculture. He believes a solution to abject poverty in sub-Saharan Africa is creating wealth through agricultural development.

Farmers are often advised to improve their soil health by growing 'fertilizer plants' like soya, which improve the soil by fixing nitrogen. Together with partners such as Leldet and TSBF, we have made these recommendations more practical for farmers, who didn't previously grow soya, by providing them with seed of improved varieties. We promote these along with a rhizobium inoculant, called Biofix, to increase rate of nitrogen fixation by the plants. Importantly, farmers adopt the improved varieties of soya and Biofix for the quick return from higher yield. It is only later that farmers will observe the impact on soil health.

We present farmers with sustainable options for improving their productivity and increasing their livelihoods and I wish more people could say the same."



The planting diagram that appears in the December 2012 issue of Shujaaaz. This encourages the use of fertilizer and manure at time of planting in a graphic form.

Fixing nitrogen from the air

Ken Giller wishes we could get more free nitrogen into smallholders' diets and soils from the air....

“Just choosing just one wish is really difficult - I've spent the past 30 years working on the role of nitrogen-fixing legumes in tropical farming systems and I guess my most important wish is that the potential of legume nitrogen fixation should be expressed strongly in the fields of smallholder farmers throughout the tropics.

It sounds so simple, but in practice it means that so many components need to come together at the same time – good grain legume genotypes, highly-efficient rhizobium strains, matched to the environment and managed well, including fertilization with all the nutrients they need to grow prolifically. Getting this to happen in practice is not as easy as it sounds...”

Ken Giller,
Plant
Production
Systems,
Wageningen
University,
and leader of
N2Africa



<http://www.n2africa.org>



Farmers show the popular seed type of new short duration varieties of cowpea in northern Nigeria

Expanding the benefits of legumes on soils

Bashir Jama wishes that greater numbers of farmers could be persuaded to grow legumes...

"I wish collectively we could persuade more farmers to expand production of legumes in Africa. This can contribute significantly to improving soil health globally in an economical and environmentally sound manner.

Legumes, through biological processes, can fix a significant amount of nitrogen from the atmosphere. Estimates range between 50 to 300kg per hectare, depending on the species and the management interventions adopted. This can reduce considerably the amount of inorganic fertilizer required. Most legumes can do this including trees and shrubs that are normally used in agroforestry systems.

Initially the most attractive legumes for resource-constrained farmers are the grain legumes. These can give multiple benefits – food that is nutritious, money from their sale, and feed for livestock. Their biomass can considerably improve organic matter and the water holding capacity of the soil. It even increases the use-efficiency of any nutrients applied to the soil.

The expanded production of grain legumes could, therefore, be an attractive mechanism to improve the soils, enhance incomes and nutrition of many Africa smallholders. To do this successfully smallholders must be able to access three things at scale:

- improved seeds
- extension and advisory services
- remunerative markets

Most legume grain varieties available to smallholders in sub-Saharan Africa are low yielding. A good example is soybeans whose yields are one to two thirds lower than those used

in Brazil. Besides improved seeds, knowledge on the use of small amounts of fertilizers, especially phosphorus, and rhizobium inoculum should be widely disseminated.

I believe this is the time to expand the production of grain legumes. Global prices are at all time highs. Soybean farmgate prices are, for instance, US\$ 500-600 per ton in many rural areas in Africa. Pigeon pea is the same.

Helping farmers aggregate their produce and take advantage of economies of scale in price negotiations is important to them accessing markets and improving their livelihoods. The need to extend technologies for reducing post-harvest losses is also important. This may require improving storage facilities in rural areas, something that will call for partnership between the public and private sectors.

I believe this is the time to expand the production of grain legumes. Global prices are at all time highs. Soybean farmgate prices are, for instance, US\$ 500-600 per ton in many rural areas in Africa. Pigeon pea is the same.

Greater production could be achieved from both increasing production per unit area or bringing more area under production. There is tremendous scope for both, especially in Africa where grain legumes are typically either intercropped or rotated with cereal and tuber/root crops – maize, sorghum, cassava, etc.

Some of the incomes derived from increased grain legumes production could be used to buy fertilizers, an expensive product in

Africa (US\$ 1000 to 1200 per ton) which, nevertheless, is required for maintaining productivity. This could, indeed, be the way to finance and increase fertilizer use by smallholder farmers in Africa, and thus improve the fertility and productivity of its soils that are currently low and declining in many areas."



Bashir is head of the Accra office and the director for Soil Health Program at the Alliance for a Green Revolution in Africa (AGRA).

He is responsible for shaping the content and scope of the soil program, and guiding investments in 13 focal countries.

Until recently, Bashir was policy advisor for agricultural and rural development with the Bureau for Policy Development, New York. He holds a PhD in agroforestry from the University of Florida at Gainesville, USA. He has worked for over 19 years with the World Agroforestry Centre (ICRAF) in Nairobi (Kenya). He has conducted research on, and published extensively on, agroforestry technologies and, in particular, on integrated soil fertility management strategies.

Fertilizer: The \$2billion questions...

Valerie Kelly wishes fertilizer could be taken off the pedestal on which it has been placed, and to encourage more rational thinking about its role in the broader context of African agricultural development.

“Soil improvement and conservation is a *sina qua non* for increasing agricultural productivity, food security and rural incomes in sub-Saharan Africa—goals to which all African nations currently aspire.

Fertilizer is one of many tools available for improving and conserving African soils. Fertilizer is not, however, a panacea that will overcome the Pandora’s box of difficult technical, economic, and policy challenges facing African agriculture.

World Soil Day 2012 gives us an opportunity to reflect on how fertilizer contributes to African soils and to broader development goals.

Since the 2006 fertilizer summit in Nigeria, African policy makers have put fertilizer on a pedestal. They argue that unless sub-Saharan Africa can increase use to roughly 50kg per hectare by 2015, there will be no chance of achieving an African green revolution.

The argument is that current average fertilizer use in sub-Saharan Africa (8kg/hectare) is a long way below that for the rest of the world (107kg/hectare)¹.

I find that the attention given to this ‘universal’ goal of increasing aggregate fertilizer use in sub-Saharan Africa overly simplifies the challenge, and results in an exaggerated emphasis on fertilizer subsidies.

ISFM research has shown how complex agricultural productivity relationships are, and underscores repeatedly that solutions are more local than national. They must be

designed to take into account the natural characteristics of different production environments (e.g. soil and climate) and the characteristics of individual farmers (e.g. productive assets, labor resources, knowledge and goals).

In most cases, fertilizer subsidies have become the dominant government contribution to the agricultural sector, with very little attention to all the supporting investments that are needed for fertilizer use to result in significant and sustained soil and productivity improvements.

Since 2006, 2.1 million tons of fertilizers have been distributed through government programs in Nigeria, Ethiopia, Kenya, Zambia, Malawi, Tanzania, and Ghana at a cost of \$2 billion. Estimates suggest that subsidized fertilizer in these countries has cost \$950/ton on average and accounts for a large share of government budgets (13.5% of the total budget in Malawi, but 40-70% of the agricultural budget, depending on the year)².

Despite these huge investments, there has been little systematic

analysis of the costs and benefits of the subsidies and the extent to which program objectives were attained. Part of the problem is that many governments do not want to look too closely at the programs, because they are enormously popular politically.

A recent paper on the need for improved discussion of the pros and cons of fertilizer subsidy programs in sub-Saharan Africa characterized the issue as a ‘wicked problem’. Such problems tend to resist resolution by an appeal to the facts. There is always more than one possible pathway towards the resolution of the problem, with each pathway depending on the core beliefs of those involved. Every ‘wicked problem’ is a symptom of another, higher level, problem – for example, poverty and underdevelopment in the case of input subsidies³.

It is discouraging to think that we may be confronting a ‘wicked problem’, lacking a rational resolution to conflicting views on the role of inorganic fertilizers in promoting soil health and on the role of fertilizer subsidies in promoting rational use of fertilizer. I wish we could do better.”

Valerie has a PhD from Michigan State University and has worked on international development, agricultural production and policy issues in developing countries since the early 1970s, with a focus on sub-Saharan Africa.

Her professional experience as an agricultural economist includes work with Michigan State University (1984-88 and 1993-present) and the International Food Policy Research Institute (1988-93).

¹FAO data 2010. IFPRI Discussion Paper 01084, 2011

^{2,3}Ricker-Gilbert, J., T. Jayne, G. Shively. 2011. Addressing the “Wicked Problem” of Input Subsidy Programs in Africa: A Review. Paper presented at the AAEA (Agricultural and Applied Economics Association) meetings, Seattle, WA, August 14, 2012

Fertilizer subsidy needs to clean up its act...

Francis Tetteh wishes policy makers made better use of mobile phones and mainstream distribution channels to wipe out abuses of the fertilizer subsidy scheme. And getting the timing of the scheme better aligned to the farming year would help too...

“Among the various agricultural inputs, fertilizer contributes about 50% of the increase in agricultural production. According to FAO, it has been increasingly realized that it is relatively cheaper, and more in the country’s long-term interest, to import fertilizer than food grains.

In Ghana the large yield gaps resulting in food deficit are attributed to low or no use of mineral fertilizer.

In the 1980s the government removed all subsidies on fertilizer. This, coupled with the elimination of guaranteed minimum prices, led to a high cost of fertilizer.

Fertilizer became unaffordable to the farmer, resulting in reduced fertilizer importation and usage. Fertilizer use in Ghana is very low (about 10 kg/ha) while nutrient depletion rates range from about 40 to 60kg of nitrogen, phosphorus, and potassium (NPK) per hectare per year (FAO, 2005).

The low use of fertilizer by farmers was due to its relatively high cost.

Fertilizer research and review of recommendations for crops lagged behind for about 40 years because high cost of fertilizer made fertilizer recommendations uneconomical. In 2008, however, the government re-introduced fertilizer subsidies through a voucher-based system to promote fertilizer use and improve the crop productivity of smallholder farmers. Implemented by the Directorate of Agricultural Extension Services of the Ministry of Food and Agriculture, the vouchers were worth 50% of the price of fertilizers.

Farmers were encouraged to use the fertilizers on mainly the key food crops – maize, rice, millet and sorghum. Fertilizer use increased, thereby stimulating fertilizer supplies in the country. The national average fertilizer application rate increased from 8 to 10kg per hectare in four years, with increased productivity.

This subsidy program came with its challenges: the subsidy is seasonal and available for only six months of the year (i.e. May to October)

and is perceived as top down. At the time the subsidy is announced/introduced, most farmers in the middle and southern belts of Ghana have planted and it is too late to apply any basal fertilizer. However, farmers in the northern belt are favored by this delayed subsidy delivery.

Most farmers use mobile phones so there is the need to introduce mobile phone based security systems to the farmers and distributors in order to simplify access to subsidized fertilizer.

There is also a perception that fertilizer is smuggled through the borders to the neighbouring countries, because the fertilizer does not reach its targeted destination. Another challenge is that fertilizer distributors do not have offices (or warehouses) in all the regions and farming communities where the subsidy program is being implemented. Transporting fertilizer to farming communities that are far from the warehouses, creates the conditions for diversion and smuggling.

To improve the management of the subsidy program and minimize diversion and smuggling, first there is a need to ensure that distributors exist in all the districts so that they can be accessible to the farmers. Secondly, most farmers use mobile phones so there is the need to introduce mobile phone based security systems to the farmers and distributors in order to simplify access to subsidized fertilizer.”

Francis is a research scientist of the CSIR-Soil Research Institute, Kumasi, Ghana.

His speciality is soil fertility and chemistry. His interest is in fertilizer recommendations for various crops, soil testing and soil health policy issues.

He has also carried out soil fertility management studies on cassava, yam, cocoyam, maize, rice, oil palm, tobacco, cocoa and cowpea. He is also a lecturer at the Crops and Soil Sciences department of Kwame Nkrumah University of Science and Technology where he supervises students pursuing higher degrees.



Organic matter matters

Mariana C Rufino and her colleagues at the International Livestock Research Institute (ILRI) wish livestock manure was considered to be a precious resource that should be carefully managed, independently of the amounts produced.

“How much do farmers value their soils?”

When we ask farmers in sub-Saharan Africa how they invest the revenues generated from farming they have plenty of good ideas - from sending their children to school, to increasing their livestock numbers or setting up small business in town. And this is perfectly understandable: they want to increase their assets to feel less vulnerable in times of crisis.

What we often see is that farmers (and scientists) fail to value soils as assets, which must be protected to reduce their vulnerability, just as much as their children and their livestock.

When soils are degraded there is nowhere to go. Nevertheless, in many parts of the world farmers haven't invested enough in the fertility of their soils, which directly increases their asset value and effectiveness against vulnerability.

Farmers rarely prioritise improving the fertility of degraded soils with manure, because handling and transporting take a great deal of labour and the benefits are not quickly observed.

In her book 'The Challenge for Africa,' Nobel Peace Laureate, the late Wangari Maathai, describes seeing a woman farmer in Cameroon cultivating her land in a way that led to severe erosion and depletion of nutrients. This woman was not deliberately destroying the resource on which her livelihood depended, she was just unaware of the consequences of her actions.



Mariana is a Livestock systems analyst at ILRI.

She received an MSc in Tropical Crop Production and a PhD in Systems Analysis from Wageningen University.

At ILRI, she is involved in various projects dealing impact assessment, multi-criteria analysis, agricultural systems productivity, nutrient cycling, adaptation to climate change and mitigation. Before joining ILRI in 2010, she worked for Wageningen University as system modeler in a number of projects in Africa funded by B&MGF, EU, and IDRC.

She has more than 10 years of experience in international research and education. Mariana has authored or co-authored more than 40 publications in peer-reviewed journals and edited proceedings.

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A good example of the lack of investment is how manure from livestock is managed. It is true that manure alone won't suffice to support the increase in the production needed to feed growing populations. However, manure is key to start soil rehabilitation processes and to trigger soil fertility improvement (Tiftonell et al. 2008).

There is a wealth of research showing that manure additions lead to increases in yield. Research has also shown that the amounts needed to increase yields at a large scale are not available, and will not be available (e.g. Rufino et al. 2011). There is, however, potential to utilize manure better to target the rehabilitation of very poor soils.

Farmers rarely prioritise improving the fertility of degraded soils with manure, because handling and transporting take a great deal of labour and the

benefits are not quickly observed.

There is no doubt that fertilizers are needed to support crop and livestock production. However, in much of the developing world vast areas have soils of such poor quality that there is no response to fertilizers. Although it might not be profitable to apply small amounts of manure to poor soils, the long-term investment on rehabilitation of soils has a larger and deeper societal benefit.

ILRI's wish: For a change in perceptions and value attached to poor soils and the realization that investments are needed to improve fertility. This will help to lead research and work with farmers to achieve such a long-term goal. Livestock manure will then be considered a precious resource that should be carefully managed, independently of the amounts produced. Our environment will benefit from such a change as well."

Tree wishes

Floice Adoyo wishes to change the tree species that are planted in Africa

“I would introduce and encourage farmers, especially women, to plant agro-forestry tree species such as *Faidherbia albida*, calliandra, Leucaena and Sesbania.

The tree cover in Africa has been depleted for timber and for burning charcoal. Replacement trees are not planted. This has exposed our soils to erosion, and so the desert encroaches on farmlands. There is an urgent need to plant trees on farms.

Agroforestry tree species can be planted on farms, as they are compatible with most crops. They are nitrogen fixing, so they can help improve soil fertility; this is an important consideration for poor smallholders facing high fertilizer costs. Improved soil fertility will lead to increased food production, improved incomes and eventually to food security.

Belief structures in parts of Africa mean women are not allowed to plant most tree varieties. Trees are seen to belong to men, and only they can plant them or cut them down.

Sesbania is an indigenous tree to some of these areas. Sesbania is used for firewood. The collection of firewood is a woman's specific duty. Women are therefore allowed to plant and fell such species – as they are not seen as permanent trees. Women do not normally have access to the 'men' planted trees, so fuel shortages can mean they have to prepare fast cooking foods, which are often less nutritious.

Agroforestry trees are not seen by men as valuable, compared to, say, eucalyptus trees, because they are not hardwood and do not grow very big.

Food production in Africa is left mainly to the women, who, in most cases, have no means of purchasing farm inputs. This results in poor crop yields.

The tree cover in Africa has been depleted for timber and for burning charcoal. Replacement trees are not planted. This has exposed our soils to erosion, and so the desert encroaches on farmlands.

Planting agroforestry trees is a plus for the community since soil fertility will improve crop yields, incomes and food security. It will also result in women's access to good quality firewood that can lead to better cooked and nutritious meals. It will also save the time women spend in searching for firewood; reduce conflict in the community and violence against women in the home (women are beaten by their husbands for poorly cooked food, and for not

cooking at all, or for not cooking on time). Furthermore trees contribute to reduction in environmental degradation.

Agroforestry trees can be planted anywhere and because of this, anybody can plant them including men, women and the youth. They can be planted in farmland on soil conservation structures, along hedges, scattered through cropland or marking the farm boundary. They can be planted as windbreaks, as ornamental trees in the compound or as woodlots where they will also improve the soil fertility of the land. The trees can be used for soil fertility (nitrogen fixing and leaves can be cut and incorporated into the soil), as livestock fodder - and healthy livestock create other useful ISFM inputs!

Some species grow into big trees such as *Grevilia* and *Faidherbia albida*. Men will be comfortable planting these as they can use the products as building materials.”



Floice Adoyo is a social scientist currently working with International Centre for Research on Women-East Africa Region as the gender and agriculture expert.

She has worked as a senior extension and training officer, a gender advisor and a consultant and has carried out various consultancies, studies and missions in Kenya, Tanzania, South Africa, Somalia and Uganda.

These include project management, evaluations and social impact assessments, gender analysis, baseline surveys and training in mainstreaming gender in policy development as well as rural development projects, development and use of participatory gender responsive extension methods, technology development, transfer and monitoring and evaluation methodologies.

A human rights perspective on women's land tenure

Margaret Kroma's wish would make women's land rights a human right enshrined in law...

"Soil fertility in Africa is at a crossroads. Its continuing depletion on smallholder farms is dangerously out of sync with Africa's burgeoning population at this threshold of the 21st century.

Current forecasts estimate a 50% population increase by 2050, signaling that the region has one of the fastest growing populations, largely dependent on food grown on the 1-2 hectare farms dominated by women smallholders.

But women hardly ever own the land they work on; recent statistics indicate in fact that in Africa less than 20% of landholders are women. Yet studies have consistently shown a direct correlation between ownership of agricultural land and adoption of practices that enhance and sustain the fertility of the soil. Because women often lack secure access to land, they tend to be reluctant to invest in soil improvement.

Productivity increases to feed Africa's growing population must go hand in hand with protecting and replenishing its soils. For this to be assured, women's right to land must be made a human right, enshrined in law. Across Africa, women's insecure land tenure and dependence on their spouses or male relatives, have led to reductions in productivity levels and poor land management.

Women's land rights, clearly incorporated into human rights instruments, will not only formalize their rights to own land but will unequivocally assert their ownership as a substantive right. This women's empowerment measure can transform both Africa's soil fertility efforts and food security of the millions of rural households that dot the countryside of many sub-Saharan African countries.

Women smallholders are already significant producers of orphan crops, many of which are legumes that increase soil biomass/ and sequester carbon. Women smallholders tend to manage complex integrated production systems serving multiple functions and purposes. Their systems are designed to optimize the productivity of crop mixes on their farm to ensure stability and resilience. This innovative management has been shown to have beneficial effects on soil fertility.

Yet studies have consistently shown a direct correlation between ownership of agricultural land and adoption of practices that enhance and sustain the fertility of the soil. Because women often lack secure access to land, they tend to be reluctant to invest in soil improvement.

Additionally, where women have secured ownership of the land they work on, they are also more likely to invest in innovative soil fertility management technologies such as micro-dosing, that employs judicious use of fertilizer to avoid harming the soil. They are also more likely to adopt and grow 'fertilizer trees' - fast growing trees and shrubs that naturally fertilize their fields, and also provide ancillary benefits such as increased water use efficiency when they have secure land rights. Similarly, women with secure land rights will be more likely to invest in conservation agriculture when they are confident that the benefits and returns to adoption accrue to them.

Africa has a fast growing population with food needs - invariably met from predominantly women smallholder's



Margaret Kroma (left) in Tamale, Ghana, working with Farmers

Margaret Kroma is a program officer, Gender and Agriculture, at the Alliance for a Green Revolution in Africa (AGRA).

Born in Sierra Leone, she joined the Alliance for a Green Revolution in Africa in 2010 from the CGIAR, African Women in Agricultural Research and Development (AWARD) project where she was the project manager. Previously she was an assistant professor in the College of Agriculture and Life Sciences at Cornell University, USA (2000-2008) where she served as faculty coordinator of various collaborative agricultural research and development projects in Ghana, Mali, Niger and Sierra Leone. Margaret has over ten years of progressive professional experience in agricultural development, gender and rural extension and holds a PhD in Rural Sociology from Iowa State University.

farms. Food productivity and soil fertility need not be mutually exclusive. The two can go hand in hand if Africa makes women's land rights a human right enshrined in law."

A bigger slice, a bigger cake...

Marie Rarieya wishes that African governments would make the investment in capacity building for agricultural research and development into use, which will help save Africa's ailing soil.

"A survey of the national agricultural research institutes found that only about 1 in 20 of their scientists specializes in soils research. This figure illustrates the capacity gap between the nature of the problem of declining soil fertility and allocation of resources to solve it.

I wish that governments would invest to build a critical mass of human resources capital, to facilitate the revitalization of soil health and agricultural transformation in Africa.

The need for capacity building in the agricultural domain is not new, but this is an area that must remain a priority in promoting sustainable growth and environmental sustainability.

Africa's soils are ailing from years of unsustainable land use and poor soil management, and the situation is exacerbated by the decline in investment in human capital for soils research and resource management.

Capacity building is a critical component of soil fertility restoration through improved land use and management practices. The capacity building needs to be injected along the entire value chain of important crops, both food and cash. African governments need to double their investment in education to meet the critical mass of people, to lead and service agriculture research and development. But it also needs to spread into extension, and where appropriate be done in partnership with private sector input suppliers. I also think that more women

in leadership roles in research institutes might see an engendered research agenda, concentrating more on the so-called 'women's' that play a critical role in household food security.

Capacity building can transform the agricultural landscape if it includes policy makers, researchers, extensionists and aspiring farmers.

For agriculture-led growth to be effective, building the capacity of smallholder farmers to make informed decisions on improving land productivity, based on agronomic practices is vital.

Women and young people will be critical to agricultural growth at farm level and governments will ignore these groups at their peril. Women, because they form the majority of workforce, and young people, because many more of them need to be persuaded that agriculture could give them a future.

Unfortunately, the agricultural extension agents who work with farmers directly are currently moribund in many African countries. Smallholder farmers need better technologies and knowledge related to improved soil nutrient management, accompanied by agronomic or field practices.

For Africa to achieve agricultural transformation, commitment to capacity building for research and development must start at the very top, with the African leaders taking center stage. The Alliance

for a Green Revolution in Africa has spelt out a vision for achieving agricultural transformation in Africa. The interpretation of this vision into on-the-ground reality is embedded within its capacity building initiatives, that cut across all stakeholders, ranging from farmers, researchers, extension and policymakers."



Marie Rarieya (left) discussing ISFM with women farmers in Kano, Nigeria

Marie joined AGRA in 2009 as program officer for Soil Health Training and Education. She plays a key role in shaping AGRA's soil health training program. This is directed at integrated soil fertility management (ISFM) capacity building for extension workers, laboratory technicians, soil scientists and others across 13 AGRA focal countries in sub-Saharan Africa. She has over 16 years' experience working on sustainable development issues in Africa at two different institutions.

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